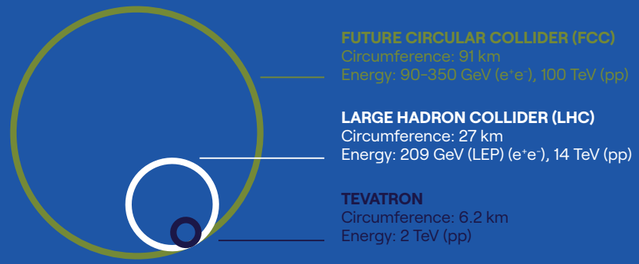
FUTURE CIRCULAR COLLIDER
STUDY



The aim of the Future Circular Collider (FCC) Study is to develop a design for a post-LHC particle accelerator facility in a global context. To expand our understanding of the fundamental laws of nature, we need to to push the intensity and energy frontiers back further. Reaching this goal within the 21st century calls for a next generation of large circular colliders.

Following the FCC Conceptual Design Report in 2019, the Feasibility Study is a direct response to a high-priority request from the 2020 update of the European Strategy for Particle Physics, which stated that: *"Europe, together with its international partners, should investigate the technical and financial feasibility of a future hadron collider at CERN with a centre-of-mass energy of at least 100 TeV and with an electron-positron Higgs and electroweak factory as a possible first stage. Such a feasibility study of the colliders and related infrastructure should be established as a global endeavour and be completed on the timescale of the next Strategy update."*

The international FCC collaboration, hosted by CERN, brings together more than 130 institutes around the globe.

By the end of 2025 the FCC Feasibility Study will conclude. The report and an active R&D portfolio of new technologies developed in collaboration with leading research institutes and industries will pave the way for a world-leading high-energy physics facility for the 21st century.

FUTURE CIRCULAR COLLIDER

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FCC

FUTURE CIRCULAR COLLIDER

OUR EXPANDING HORIZONS

FUTURE CIRCULAR COLLIDER STUDY

WHAT

The Future Circular Collider (FCC) Study explores the feasibility of circular particle collider scenarios with the aim of significantly expanding the current luminosity and energy frontiers.

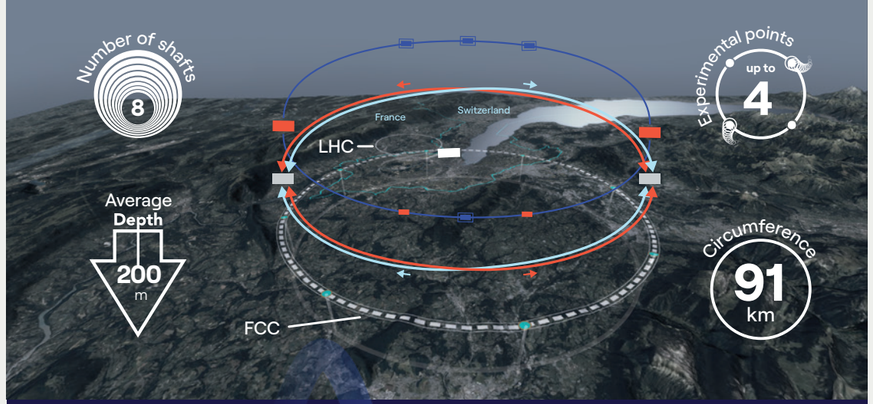
The Large Hadron Collider (LHC) at CERN, with its high-luminosity upgrade, will be the world's primary instrument for exploring the energy frontier until ~2040.

The LHC programme sets the time window for preparing a post-LHC high-energy physics research facility. The FCC Study complements existing designs for linear electron–positron colliders (ILC and CLIC). The first stage of the FCC will be a high-luminosity high-energy electron–positron collider; the second stage will be an energy-frontier hadron collider, with a centre-of-mass energy of the order of 100 TeV. The FCC Study explores the physics cases for each collider scenario in a coordinated way that embraces discovery and precision physics. The work programme includes experiment and detector concept studies with a view to exploring new physics.

Realising these machines requires pushing technological boundaries. FCC-ee research and development (R&D) focuses on improving the overall efficiency, on obtaining the measurement precision required, and on achieving the target performance.

The foundations for these advancements are being laid in focused R&D programmes:

- integrated **concept for managing and reusing excavated materials,**
- sustainable **energy management concept** for the construction and operation,
- **improve the efficiency of key accelerator technologies** to secure a sustainable operation (including radiofrequency acceleration systems, large-scale cryogenics infrastructure and superconducting technologies).



WHY

The discovery of the Higgs boson was a milestone in the long-standing effort to complete the Standard Model of Particle Physics. This theory describes the fundamental particles that make up the visible universe – including us – along with most of the interactions that govern their behaviour. Yet the Standard Model cannot explain several observations, such as:

- **evidence for dark matter,**
- **prevalence of matter over antimatter,**
- **the neutrino masses.**

The FCC, with its high-precision and high-energy reach will extend, well beyond the LHC, the search for new particles and interactions, which could hold the key to understanding those unexplained phenomena. Creativity and innovation are needed to develop the physics case, meet the required accelerator parameters and conduct unprecedented experiments.

FCC - ee

at least **15** years of operation

years
- 8 preparatory phase
- 10 construction
- 15 operation

FCC - hh

at least **25** years of operation

years
- 10 installation and commissioning
- 25 operation

The goal is to ensure the seamless continuation of the world's particle physics programme after the LHC era.

HOW

The FCC Study hosted by CERN is an international collaboration of more than 130 institutes from all over the world. This prepares the ground for geographically well-balanced contributions, leveraging the competences of world experts in the numerous areas concerned.

It also ensures that the worldwide scientific community is involved from the very start of the endeavour. Bringing together physics, experiments, accelerator concepts and technology R&D within a single study will result in a coherent and consistent design for a future large-scale research facility.

The experience from the operation of LEP and LHC, together with the unique opportunity to test the novel technologies in the High-Luminosity LHC and other lepton colliders around the world, provide a solid basis for assessing the feasibility of a post-LHC particle accelerator. The EU's Horizon 2020 programme continuously supports the FCC Study through the EuroCircol, MSCA EASItrain and FCCIS projects.

> 130 Institutes

> 30 Countries

> 30 Companies

- ACCELERATORS
- PHYSICS
- PLACEMENT STUDIES
- INFRASTRUCTURES
- EXPERIMENTS & DETECTORS
- SOCIO-ECONOMIC IMPACT